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Clean Version of Pending Claims

SELECTIVE DEPOSITION OF SOLDER BALL CONTACTS

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Serial No.: 09/253,611



Claims 1, 3-12, 64-65, 68, and 71 as of January 17, 2002 (Date of Response to Final Office Action and RCE filed).

- Sub E7
- DZ
1. (Amended) A method of forming a solder ball contact, comprising:
forming a metal contact pad on a substrate;
forming an insulating layer on the metal contact pad;
removing a portion of the insulating layer to expose a portion of the metal contact pad,
thereby forming an exposed portion of the metal contact pad, the exposed portion having a
predetermined diameter;
immersing the substrate in molten solder;
depositing solder on the exposed portion of the metal contact pad using selective
chemical vapor deposition or selective electrolytic deposition, thereby forming a solder contact
by selectively depositing solder only on the exposed portion of the metal contact without
depositing solder on the insulating layer and without removing a remaining portion of the
insulating layer; and
annealing the solder contact to form a solder ball contact having a diameter in a range of
about 2.5 microns to no greater than 100 microns.

- Sub E7
- D3
- Cont
3. The method of claim 1, wherein depositing solder further comprises depositing at least
one material selected from the group consisting of lead, tin and bismuth.
 4. The method of claim 1, wherein forming a metal contact pad further comprises:
forming a layer of zirconium on the substrate;
forming a layer of nickel on the layer of zirconium;

forming a layer of copper on the layer of nickel;
forming a layer of gold on the layer of copper; and
forming a layer of lead on the layer of gold.

- D3
Cont
5. The method of claim 1, wherein forming a metal contact pad further comprises:
forming a layer of zirconium on the substrate, wherein the layer of zirconium is
approximately 500 Angstroms thick;
forming a layer of nickel on the layer of zirconium, wherein the layer of nickel is
approximately 750 Angstroms thick;
forming a layer of copper on the layer of nickel, wherein the layer of copper is
approximately 5000 Angstroms thick;
forming a layer of gold on the layer of copper, wherein the layer of gold is approximately
750 Angstroms thick; and
forming a layer of lead on the layer of gold, wherein the layer of lead is approximately
500 Angstroms thick.
 6. The method of claim 1, wherein annealing the solder contact to form a solder ball contact
comprises a solder ball contact approximating a spherical shape.
 7. The method of claim 1, wherein annealing the solder contact to form a solder ball contact
comprises a solder ball contact having a spherical portion and a flat contact portion.
 8. The method of claim 1, wherein removing a portion of the insulating layer further
comprises forming an exposed portion of the metal contact pad having a diameter of
approximately 2 microns.

- Sub 37
9. (Amended) A method of forming a solder ball contact, comprising:
forming a metal contact pad on a substrate;
forming an insulating layer on the metal contact pad;
removing a portion of the insulating layer to expose a portion of the metal contact pad,
thereby forming an exposed portion of the metal contact pad;
immersing the substrate in molten solder;
depositing solder on the exposed portion of the metal contact pad, thereby forming a
solder contact by selectively depositing solder only on the exposed portion of the
metal contact and not depositing solder on the insulating layer;
maintaining remaining portions of the insulating layer surrounding the solder; and
annealing the solder contact to form a solder ball contact having a diameter in a range of
about 2.5 microns to no greater than 100 microns.
- D3
Cmt
10. The method of claim 9, wherein immersing the substrate in molten solder comprises
immersing the substrate in molten solder having at least one material selected from the
group consisting of lead, tin and bismuth.
11. (Amended) A method of forming a solder ball contact, comprising:
forming a metal contact pad on a substrate;
forming an insulating layer on the metal contact pad;
removing a portion of the insulating layer to expose a portion of the metal contact pad,
thereby forming an exposed portion of the metal contact pad, wherein the exposed
portion of the metal contact pad has a diameter of approximately 2 microns;
immersing the substrate in molten lead;
selectively depositing lead on the exposed portion of the metal contact pad, thereby
forming a solder contact in which solder is selectively deposited only on the
exposed portion of the metal contact and not on the insulating layer; and

annealing the solder contact to form a solder ball contact without removing remaining portions of the insulating layer .

12. (Amended) A method of forming a solder ball contact, comprising:
- forming a metal contact pad on a substrate;
 - forming an insulating layer on the metal contact pad;
 - removing a portion of the insulating layer to expose a portion of the metal contact pad, thereby forming an exposed portion of the metal contact pad, the exposed portion having a predetermined diameter;
 - adsorbing reactants on the exposed portion of the metal contact pad;
 - reacting the reactants on the exposed portion of the metal contact pad, thereby forming a solder contact only on the exposed portion of the metal contact pad and not on the insulating layer;
 - annealing the solder contact to form a solder ball contact having a diameter in a range of about 2.5 microns to no greater than 100 microns ; and
 - leaving remaining portions of the insulating layer as a passivation layer.

64. The method of claim 8 wherein annealing the solder contact further comprises annealing the solder contact to form a solder ball contact having a diameter of approximately 2.5 microns.

65. The method of claim 11 wherein annealing the solder contact further comprises annealing the solder contact to form a solder ball contact having a diameter of approximately 2.5 microns.

68. The method recited in claim 1 performed in the order recited.

- Sub E47
71. A method of forming a solder ball contact, consisting essentially of:
- forming a metal contact pad on a substrate;
 - forming an insulating layer on the metal contact pad;
 - removing a portion of the insulating layer to expose a portion of the metal contact pad,
- thereby forming an exposed portion of the metal contact pad, the exposed portion having a predetermined diameter;
- D6
- immersing the substrate in molten solder;
 - depositing solder on the exposed portion of the metal contact pad using selective deposition, thereby forming a solder contact; and
 - annealing the solder contact to form a solder ball contact having a diameter in a range of about 2.5 microns to no greater than 100 microns.
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